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Jong, Gjalt de; Klein Woolthuis, Rosalinde

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The Effects of Trust on Performance of High-Tech Business Relationships

Gjalt de Jong

University of Groningen
Faculty of Economics
P.O. Box 800
9700 AV Groningen, The Netherlands
g.de.jong@eco.rug.nl

Rosalinde Klein Woolthuis

Vrije Universiteit Amsterdam
Faculty of Social Sciences
De Boelelaan 1081c
1081 HV Amsterdam, The Netherlands
rja.klein.woolthuis@fsw.vu.nl

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ABSTRACT

We investigate the effects of trust propensity, cognition based trust and affect based trust on relationship performance in terms of openness, conflicts and success. Data from a field study of 391 Dutch firms in high tech industries support the research model. Trust that derives from affection is key and outweighs cognition based trust and trust propensity. Openness increases success that in turn fosters the development of affect based trust. The results provide preliminary but convincing evidence for the value of relational capital in durable business relationships that strive for the development of new technological knowledge.

Key words: Business Relationships; Trust; Conflicts; Openness; Success.

1. INTRODUCTION¹

In recent decades interfirm collaboration increasingly has become important. This particularly applies for the development of new knowledge in high tech industries. Business relationships in these industries may offer substantial future benefits. However, due to substantial dedicated investments that are needed to develop new technologies, such interfirm relationships share risks as well. Firms need to craft governance mechanisms to safeguard the risks. Achieving a greater understanding of the link between potential future benefits and governance is therefore important for firms who are, or soon going to be, involved in high tech collaborative efforts. In this article, we examine how vulnerable firms use trust to manage the performance of their business relationships.

Business relationships in high tech industries share three specific characteristics. Firstly, the development of new technological knowledge is essentially different from the development of new commodity products. New technological knowledge is a case of intangible capital – no market and thus price mechanism for such capital exists. Firms with complementary competencies have to develop new technological knowledge themselves. This requires dedicated investments and a sufficiently durable relationship to recoup these investments. It does not entail that relations should last endlessly. Indeed, relations can become too durable, yielding rigidities and lack of variety that is needed for learning.

Secondly, the development of new technological knowledge (innovation) requires a combination of products, markets, technologies and organizational capabilities that most companies do not have in-house and for which reason they have to cooperate with complementary specialists (cf. Zagnoli and Cardini 1994). Open communication and sharing of highly specialist knowledge is a necessary condition that needs to be met otherwise new knowledge cannot be developed in the first place. Specialist knowledge, however, often is strictly confidential because it is this type of knowledge

¹ Hans van Ees has made valuable comments and suggestions for which the authors are grateful. The usual disclaimer applies.

that offers competitive advantages. Sharing of such knowledge shares risks of spillover and loss of market shares particularly when the (potential) partner firm is a (future) competitor. Firms have strong incentives to manage these risks of spill-over.

Thirdly, business relationships in high tech industries are often characterized by much uncertainty and great interdependence. For that reason it is very difficult or even impossible to write complete contingent contracts prior to the relationship. This implies that many issues and unforeseen circumstances need to be managed during the relationship. This is important because misunderstandings, conflicts, changing expectations and conflicting interests among parties are inevitable in durable relationships (Ring and Van de Ven 1994). Because none of the partners has formal authority over the other, this may mean that collaborative firms rethink and renegotiate contested issues during the relationship. The joint characteristics of uncertainty with interdependence in combination with the complexity of the innovation process make the management of high tech relationships challenging.

The impossibility to write complete contingent contracts – as well as to vertically integrate – means that firms involved in high tech relationships need to rely on alternative governance mechanisms. Recent studies on interorganizational exchange candidate trust for this. It would be beneficial when a firm trusts the capabilities of a partner to perform the negotiated tasks, as well as to trust its integrity to deal with the shared information in such a way that it will not be misused. Various theoretical and empirical studies have examined the role of trust in business relationships (see, for example, the 1998 Academy of Management Review special issue, guest edited by Rousseau et al., the 2001 Organization Studies special issue, guest edited by Bachman et al., and the 2003 Organization Science special issue, guest edited by McEvily et al.). A non-exhaustive list of interesting findings that derive from these studies is the following. Trust increases commitment (Ganesan 1994, Garbarino and Johnson 1999, Morgan and Hunt 1994) and the willingness to accept control by other parties (Martin 1991, Mønsted 1998); trust promotes openness (Sabel 1993) and increases the efficiency of relationships (Bradach and Eccles 1989, Dyer and Chu 2003, Zaheer and Venkatraman 1995); trust reduces the need for monitoring (Anderson and Narus 1990,

Bradach and Eccles 1989, Nooteboom 1996) and vertical quasi-integration (Poppo and Zenger 2002); trust decreases ex ante and ex post transaction costs (Dyer and Chu 2003, Gulati 1995, Larson 1992).

Despite an increasing consensus on the important role of trust in business relationships, the concept itself is still suffering from a lack of conceptual clearness and generic empirical support. Discussions on what trust is seldom distinguish well between rational grounds of trust and emotional foundations. For example, game theoretic interpretations often equate trust to prior successful relationships (Axelrod 1984). Here, trust is a *rational* extrapolation of behavior and competences ‘proven’ in previous relationships. Others have argued that more or less formal institutions such as contracts and legal systems form the basis for trust (Williamson 1993, Zucker 1986). In these cases, trust is a situation where the incentives and opportunities for opportunism are cut off and hence leaves the actors little choice but to behave trustworthy. In such situations, trust is both *rational and calculative*, and has become impersonalized. The same can be argued for ‘social embeddedness’. Social embeddedness can cut off paths for incentives and opportunities of opportunism through mechanisms like reputation, family ties, exclusion and retaliation, and for that reason leaves no other alternative than ‘to trust’.

The aforementioned sources of trust rely on a rational deliberation of the risk that the other lacks competences or goodwill and/or of the risk for punishment (retaliation) for oneself. Next to these rationalized approaches of trust we identify a group of researchers who perceive trust to be ‘that something’ that cannot be grasped easily. According to Bradach and Eccles (1989) and Lewis and Weigert (1985), for instance, trust is a ‘cognitive leap’ beyond the expectations that reason and experience alone would warrant. This conceptualization of trust differs from the rationalized expectation approach (calculations, reasons, experiences). Trust in terms of ‘that ungraspable something’ derives from a positive perspective of human behavior and decision-making. Instead of reasoning that potential punishments reduce opportunities for opportunism these scholars argue that it is because of an intrinsic motivation that trust reduces opportunism. This intrinsic motivation follows from feelings of

friendship, loyalty, care, concern and empathy (Chen 2000, Fehr et al. 2001, Lewicki and Bunker 1996, Macaulay 1963, Macneil 1980, Maguire et al. 2001, McAllister 1995).

This paper empirically investigates the role of more rational and more emotional forms of trust in high-tech business relationships. More in particular, we study causalities between three different forms of trust and three different characteristics of relationship performance, i.e. openness, conflicts and success. To the best of our knowledge, this study is one of the few that simultaneously investigates causalities between *different* forms of trust with *different* characteristics of relationship performance. Hence, whereas some studies illuminate the concept of trust by distinguishing between its constituent elements (Mayer et al. 1995, McAllister 1995, Nooteboom 2002) and others examine effects of trust on performance (Anderson and Narus 1990, Serva et al. 2003, Zaheer et al. 1998) the combination of both is rare in particular for studies of business relationships in high-tech industries.

The outline of this paper is as follows. We further explore the concept of trust in Section 2 and hypothesize the effects of trust on relationship performance in Section 3. In Section 4 we specify our research methods. The results of this study are reported in Section 5. We end with a discussion, limitations and further research issues in Section 6.

2. TRUST

Definitions of trust

We first need to distinguish trust from its related concepts like risk, predictability and vulnerability to arrive at a clear definition of trust. Trust is often related to risk but it is not the same. Trust increases the willingness to become vulnerable, i.e. to *take* risk (Mayer et al. 1995). This risk is a result of uncertainty with regard to potential opportunism, relationship characteristics and contingencies. Trust is meaningless if these risks were absent. When opportunism could be guaranteed to be absent and/or when actors would be completely rational and fully informed, trust would not be needed because all future circumstances could be predicted with great certainty. This

also entails that trust is not equal to confidence or predictability. Whereas confidence refers to a situation in which one does not have to consider alternatives, trust refers to preferences for particular actions over others despite the possibility of being disappointed (Luhmann 1988). This implies that in situations of trust, risks are recognized and a conscious choice is made to take these risks (McAllister 1995). In situations of confidence one would not have this choice and would simply accept all risks.

Despite the fact that people choose to become vulnerable, this does not mean that they solely do so because the other's behavior is predictable. Deutsch (1973) argues that trust goes beyond predictability since untrustworthy behavior can be just as predictable. He concludes that trust is based on the expectation that one will find what is expected rather than what is feared. In other words, it is not predictability but the positive expectation that is distinguishing for trust. The concept of vulnerability is central to this discussion. Trust alleviates the fear of vulnerability even when direct control and monitoring is impossible (Gambetta 1988). Vulnerability therefore is also considered a crucial characteristic for the definition of trust.

Domain specificity is a final distinguishing factor. Trust is directed to some specific domain in which a partner is considered to be capable of exerting influence or performing a certain task. Nooteboom (2002) has extended this aspect by distinguishing between trust in competences (i.e., a partner's capability to perform the agreed upon task) and trust in intentions or goodwill (i.e., a partner's good intentions to do its best and to be loyal).

When the aforementioned characteristics are combined into one we arrive at the following description of trust. Trust involves a conscious choice to be or to become vulnerable. This choice is based on the positive expectation that another's behavior will not be detrimental to one's own interests, irrespectively of the possibility to monitor or to control this behavior. And trust is directed at a specific domain. In line with Mayer et al. (1995) we adopt the following definition of trust: trust is the willingness of a party to be or to become vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespectively of the ability to directly monitor or to control that other party.

Sources of trust

Now that we have defined the concept of trust, it is still unclear on what basis one trusts. Why is one willing to become vulnerable to the actions of another? How does trust come into being? Is trust based on rational calculations, on feelings and/or emotions or on a shared history of positive experiences? We hypothesize that partners in a business relationship have three bases on which they trust.

First, there is the propensity to trust. Trust always has an initial value and trust propensity reflects the initial willingness to trust (Mayer et al. 1995). By definition, some persons are more inclined to trust than others. Two opposite positions can be distinguished: there are those who start with trust and only distrust when trust is broken, and there are those who distrust until one has proven to be trustworthy. The propensity to trust is a personality trait and is developed through education, (inter)personal- and professional experiences. Also, it may be co-determined by institutions such as nation-wide cultures, industries and/or social classes in which actors are embedded. The initial level of trust can be considered as a given value when people enter into business relationships. It is a predetermined and relatively stable personality trait that is not likely to change over time.

Next, there is cognition based trust. Cognition based trust comes close to the game theoretic interpretation of trust (Axelrod 1984). Because of its relevance to economic transactions and its rationality, economists most commonly refer to this type of trust. Cognition based trust predominately is based on knowledge of past behavior (Gulati 1995, Larson 1992, McAllister 1995, Zucker 1986). This knowledge provides an expectation of future behavior via some form of rational extrapolation. This rational extrapolation of past experiences into expected future behavior may involve goodwill as well as competences because both can be identified in previous relationships.

Finally, there is affect based trust. Because of bounded rationality there always are limits to knowledge. Therefore, business partners may also have to rely on their feelings and/or intuition in deciding whom to trust or not to trust. McAllister (1995) concludes that “behavior recognized as personally chosen rather than role prescribed, serving to meet legitimate needs, and demonstrating interpersonal care and concern rather than

enlightened self-interest may be critical for the development of affect based trust” (1925: 29). In other words, affect based is about liking and caring for each other. It is not calculative but social. This does not mean that affect based trust is irrational. Norms of social obligation and inclinations to feel responsible for another one’s well being can form perfectly rational grounds to demonstrate certain behavior. Nevertheless, affect based trust predominantly is determined by feelings and the impact of rationality, if any, is limited.

Many studies mix rational with emotional sources of trust. This may cause a lack of empirical support or conflicting results about the role of trust in business relationships. Therefore we explicitly separate different sources of trust and incorporate these in our research model. To be sure we want test this proposition with the data in our sample. Hence we come to our first hypothesis:

Hypothesis 1. Trust can be distinguished into trust propensity, cognition based trust and affect based trust.

3. TRUST AND RELATIONSHIP PERFORMANCE

Now that we have identified the different forms of trust, we will relate these to our three dimensions of relationship performance, i.e. openness, conflicts and success. To some extent, the available studies on trust guide us in developing hypotheses. Larson (1992), for instance, indicates that prior exchange relationships and reputation (and thus rational, cognition based trust) mainly play a role in the first stages of a relationship, i.e. when partners are selected and initial agreements are established. Zand (1972) studies effects of trust that comes close to our concept of affect based trust. He argues that the key effect of trust is that parties become more open, accept more influence and show less defensive behavior. Trust facilitates interpersonal acceptance and openness of expression, whereas mistrust evokes interpersonal rejection and arouses defensive behavior. Affect based trust would thus more likely have an effect on relationship characteristics such as openness and conflicts. We use these insights as point of departure to formulate the hypotheses that construct our

research model.

Trust and openness

Effective communication is identified as a prerequisite condition for successful relationships in general, and for inter-firm collaboration in particular (Anderson, 1990, Boersma 1999, Luo 2002). Communication facilitates the sharing of information and to be effective, communication has to be clear and truthful. All relevant information needs to be shared at all times even when it is difficult or painful to do so. According to Zand (1972) persons who trust each other will provide relevant, comprehensive, accurate, and timely information, and thereby contribute realistic data for problem solving efforts. Hence we come to our second hypothesis:

Hypothesis 2. Trust propensity, cognition based trust and affect based trust are positively related to openness.

Trust and conflicts

As argued before, high tech relationships are characterized by uncertainty and interdependence and are hence difficult to safeguard by complete contracts prior to the relationship. As a result, many issues will and need to be arranged during the relationship. In an effective relationship, unforeseen circumstances will be dealt with in a flexible and constructive manner. Changed circumstances, however, also may lead to conflicts. Partners in business relationships have two options to respond to conflicts (Helper 1987, Hirschman 1970). Either they can end the relationship (exit) or they can try to solve the conflict (voice). In 'exit' situations, trust is often absent and power used via e.g. legal enforcement of contracts. This may lead to increased defensive behavior, more or deepened conflicts and an increased need for using additional power to overcome this resistance (Deutsch 1973, Gaski 1984). According to Sako and Helper (1998), 'voice' will be more likely in a situation where parties trust each other. People who trust each other will expose themselves more easily, are more receptive to suggestions of the partner, accept more interdependence, and have less needs to control the other. Therefore, the likelihood of misinterpretation of each

other's behavior decreases. As a result, problems are more likely to be identified, openly examined, and solutions are more likely to be appropriate and creative (Zand 1972). This enables an 'open' environment that fosters constructive cooperation. Hence we come to our third hypothesis:

Hypothesis 3. Trust propensity, cognition based trust and affect based trust are negatively related to the level of destructive conflicts.

Conflicts, openness and success

In the introduction we posited trust to have a positive effect on relationship efficiency and effectiveness due to increasing openness and decreasing levels of destructive conflicts (Bradach and Eccles 1989, Dyer and Chu 2003, Zand 1972). Through openness, problems can be timely signaled. This enables timely resolutions to problems. Thereby, conflicts can be solved without harming the performance of the relationship. The side effect of this is that it deepens trust and fosters commitment (Sabel 1993). Hence we come to our fourth hypothesis:

Hypothesis 4. Openness is positively related to success, while conflicts are negatively related to success.

Feedback mechanisms

A limited number of studies have analyzed all stages of business relationships, i.e. partner selection, initiation, development and termination (Gulati 1995, Ring and Van de Ven 1994, Serva et al. 2003). These studies emphasize that interfirm collaboration is a process in which feedback mechanisms play a crucial role. This particularly applies for trust and the performance or success of a relationship. Ring and Van de Ven (1994), for example, describe how performance and trust continuously are evaluated against norms of fair dealing and efficiency. The more successful relationships are, both in terms of performance and relationship quality, the more each partner appreciates the other's fairness, trustworthiness and competences. Hence, feedback effects of success on trust are crucial and will continue until the relationship

is terminated (Anderson and Narus 1990, Ganesan 1994, Martin 1991). It are these dynamic mechanisms that explain the continuation of a business relationship. We exclude the propensity to trust from feedback effects because trust propensity is assumed a stable trait. Hence, we come to our final hypothesis:

Hypothesis 5. Success is positively related to cognition based trust and affect based trust.

Control variables

Any model with a set of focused relationships requires that rival hypotheses be discounted. We therefore incorporate four variables that are recognized as having an influence on relationship performance, i.e. firm size, dependence, cultural congruence and contract completeness. In our model we relate the control variables to the each of the three dimensions of relationship performance.

Size. We include firm size as a variable in our model to control for extraneous factors such as bargaining power and resource base. These factors may influence the governance and performance of business relationships, i.e. co-determine openness, conflicts and success. Large firms have the resources to make investments in the development of new technological knowledge; they may be more successful in directly extracting hostages than smaller firms and thus be less dependent on bilateral governance mechanisms such as trust to protect their confidential, proprietary knowledge.

Dependence. Resource dependence theory (Pfeffer and Salancik 1978) suggests that the extent to which a firm is dependent on another firm influences the character of interorganizational relationships and is thus likely to be influential in determining the nature of governance mechanisms and performance as well. For example, a focal firm's dependence on the knowledge of a partner firm is likely to influence the focal firm's governance choices in the relationship. Also, a lack of dependence makes firms less vulnerable for opportunistic behavior making both trust and contracts

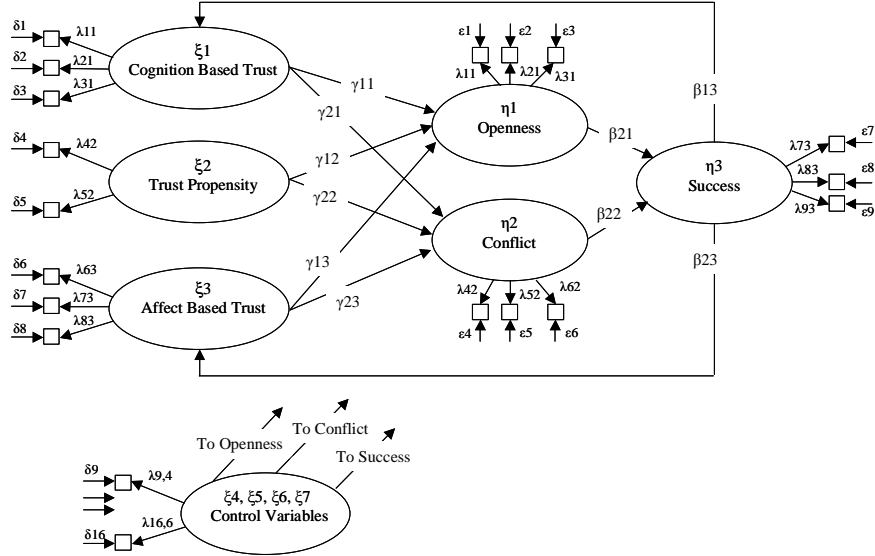
unnecessary or even meaningless. We therefore included dependence in the model to examine the influence dependence has on performance over and above that attributable to the level of trust in an exchange.

Cultural congruence. The more similar partners are in terms of culture, education, gender or age, the more likely it is that the people will intuitively understand and trust each other (Hellriegel et al. 1992). Identification goes even further: it entails that people think and feel in the same way, sharing similar views of the world and norms of behavior (Lewicki & Bunker 1996, McAllister 1995). This may lead to feelings of friendship and that actors are not able, or not willing, to consider the possibility of being untrustworthy herself, or the other to behave opportunistically. Generally, an optimal fit between firms is considered to be a key explanatory variable for organizational and relationship success (Balakrishnan and Koza 1993, Datta and Puia 1995, Shane 1992).

Contract completeness. There has been a long and vivid debate on the role of contracts, trust, performance and the interrelatedness between these concepts. On the one hand, contract theory argues that contracts form a rational basis for trust (Chen 2000, Lyons and Metha 1997, Williamson 1993, Zucker 1986). Efficient outcomes (i.e., high performance and success) are the result of complete contracts. On the other hand, social theory assumes a detrimental effect of contracts on trust because contracts will increase defensive behavior; thereby increasing transaction costs and decreasing the likeliness of successful outcomes (Dyer and Chu 2003, Goshal and Moran 1996, Zand 1972). Whatever the outcome, contracts may be important in business relationships that are initiated to develop new technological knowledge. Any model that intends to analyze these relationships needs to account for contracts.

Our research model is represented in Figure 1. All notations in the figure follow the standard conventions of structural equation modeling (Jöreskog and Sörbom, 1993).

FIGURE 1
Research Model and Hypothesized Relationships^a



^a Four control variables, size (ξ_4), cultural congruence (ξ_5), dependence (ξ_6), and contract completeness (ξ_7), were modeled as distinct independent constructs but are not shown individually in the diagram in the interests of presentation clarity.

4. METHODS

Research context

This study focuses on relationships between two or more firms and/or research institutes that operate in high tech industries (biotechnology, new material development, information technology, maritime technologies and environmental technology). The lifecycle of R&D in these industries is very short. Much of the new technological knowledge is quickly outdated often even before it has been incorporated in new products

and/or services. Also, R&D activities require substantial investments almost impossible to cover by an individual firm. Hence, particularly in the high tech industries we find much collaborative efforts between (rival) firms. Uncertainty, interdependence and complexity are some of the key characteristics of these relationships.

In the preparatory phase of the fieldwork, we conducted twenty-five semi-structured interviews with consultants who had been involved in interfirm R&D projects in high tech industries. This provided us with a wealth of information on the industries, interfirm relationships and the development of new technological knowledge. We used this information for the design of our research (design of the survey, respondents).

We collected field data by surveying companies that were involved in high tech business relationships. The sample was selected from 648 high tech projects listed in the database of a Dutch subsidizing agency. By focusing on collaborative projects in high tech sectors, we reduced the range of extraneous variations that might influence the constructs of interest.

Measures

For nine of the ten constructs, measures validated in previous studies were adapted to the context (an Appendix with the items and scales is available from the first author upon request). We developed a new measure for the construct 'contract completeness'. The measure of contract completeness was developed using the knowledge and advice of a legal expert on R&D agreements. This resulted in thirteen contractual clauses that together comprise a complete contract for interfirm relations in high tech industries. We used eight items to measure trust, the items were adapted from McAllister (1995) and Nooteboom et al. (1997). We measured openness using three items adapted from Anderson and Narus (1990) and Heide and John (1992). Conflict was measured by three items adapted from Anderson and Narus (1990) such that not only the occurrence of conflicts, but also the harmfulness of conflicts to the relationship was taken into account. Success was measured by three items adapted from Anderson and Narus (1990). Size was measured by the number of employees and the annual turn-over of the focal firm. We measured dependence using two items adapted from Nooteboom et al. (1997).

Survey design and administration

The measures were field-tested in a sample of ten companies involved in joint R&D projects. This resulted in a few adjustments to the questionnaire. A professional team of a research company conducted telephone interviews with 572 business managers. Prior to the interviews, we trained this team on peculiarities of R&D, high tech industries and interfirm relationships. The average duration of an interview was two hours. The team made three attempts to identify and interview the selected respondents. The case firms were identified from a database on interfirm high technology projects published by a Dutch subsidizing agency. The selected projects were recently finished or close to the final stage. This procedure ensured that business managers could easily be identified and were able to reflect on the performance of the interfirm relationship. Since these managers take the lead in interfacing with partner firms, they were deemed the most knowledgeable informants about the interfirm relationships.

Response rate and non-response bias

We received 391 usable responses, giving us an effective response rate of 69 percent. This rate is considerably higher than those observed in prior studies on interfirm relationships (Anderson and Narus 1990, Poppo and Zenger 2002, Subramani and Venkatraman 2003). We examined the possibility of nonresponse bias by asking nonrespondents for their reason not to cooperate in the survey. The most common reasons given, that the relevant manager was too busy, that the company's policy was to not respond to surveys or that they had recently cooperated in other surveys, provided no evidence of a systematic nonresponse that would affect the results.

5. RESULTS

Descriptive statistics

We estimated the model using LISREL 8 (Jöreskog and Sörbom, 1993). This approach allowed us to estimate the psychometric properties of measures, using the measurement models, and the hypothesized interconstruct relationships, using the

structural model.

The sample comprised 47 percent small size firms (i.e., less than 250 employees) and 53 percent medium to large size firms (i.e., more than 250 employees). Approximately 24 percent of all respondents worked for research institutes. All respondents were business managers and directly responsible for the interfirm collaboration. The interfirm relationships included projects in the fields of biotechnology (15 percent), information technology (21 percent), environmental technology (11 percent), new material development (25 percent), maritime technologies (10 percent) and other high tech industries (18 percent). The means, standard deviations, and zero-order correlations of constructs are in Table 1.

TABLE 1
Descriptive Statistics and Zero-Order Correlations ^a

Construct	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. Trust Propensity	7.87	2.40									
2. Cognition Based Trust	11.17	3.98	-.01								
3. Affect Based Trust	13.28	2.42	.14 **	.15 **							
4. Openness	14.04	1.57	.13 **	.09 *	.56 **						
5. Conflict	4.50	2.46	-.14 **	-.15 **	-.75 **	-.50 **					
6. Success	12.55	2.58	.16 **	.14 **	.55 **	.40 **	-.56 **				
7. Size	6.71	2.29	-.12 *	.03	.04	.05	-.03	-.03			
8. Cultural Congruence	17.23	3.40	.15 **	.22 **	.71 **	.41 **	-.69 **	.48 **	.04		
9. Contract Completeness	8.81	3.22	.09 *	-.05	-.02	.09 *	-.06	.06	.13 **	-.03	
10. Dependence	5.16	2.70	-.10 *	.03	-.06	-.09 *	.09 *	-.12 **	.01	-.01	-.15 **

^a $n = 391$

* $p < .05$

** $p < .01$

Measurement properties

We estimated the measurement models for both independent and dependent variables. The constructs displayed statistically significant item loadings (t -values > 2) and composite reliability above 0.6 (Bagozzi and Yi 1988). An Appendix with the parameter estimates for the measurement models is available from the first author upon request. The results for the measurement models are also used to test our first hypothesis. Eight items were selected to measure trust. The exploratory factor analysis (Table 2) results in three different dimensions.

TABLE 2
Factor Results for Trust ^a

Item	Description	Factor 1: Cognition based trust	Factor 2: Affect based trust	Factor 3: Trust propensity
TR1	If the situation allows us to, our company prefers to work alone.	-.02	.05	.88
TR2	In our company we have a culture directed towards cooperation and cooperative ties with external partners.	.02	.08	.87
TR3	Our current relationship is a continuation of a previous, long-term relationship.	.91	.09	-.08
TR4	We only knew each other for a short while but thought we could manage the project together.	.87	.07	-.03
TR5	Before this project a friendly relationship had already been established.	.77	.02	.03
TR6	During the project, our partner treated our problems constructively and with care.	-.03	.86	.02
TR7	I have never had the feeling of being misled.	-.06	.76	.18
TR8	We understood each other well and quickly.	.20	.80	-.04

^a Scale: 1 = “strongly disagree”; 3 = “neither agree nor disagree”; 5 = “strongly agree.”

Based on the items we identified the first factor to measure cognition based trust; the second factor to measure affect based trust; and the third factor to measure trust propensity. The results from the confirmatory factor analysis also confirm the three-folded classification of trust. Hypothesis 1 is thus fully supported.

Tests of the hypotheses

LISREL 8 results of the research model suggest acceptable model specification.. Values for the goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI) are 0.99 and 0.94, respectively. The value of the comparative fit index (CFI) is 0.99, and that of the non-normed fit index (NNFI) 0.95, suggesting that the data support the research model. The value of the chi-square statistic is significant indicating a less optimal fit ($\chi^2 = 10.78$, $p < 0.05$). The root-mean-square error of approximation (RMSEA) is 0.04; the 90 percent confidence interval for this estimate is within the acceptable range and is lower than 0.05. Table 3 presents the fit estimates for the research model as well as the parameter estimates for the structural model. The findings from the tests of the remaining hypotheses follow.

TABLE 3
Structural Parameters and Hypotheses

Path	Hyp.	Par.	Stand. Est.	<i>t</i>	
Cognition Based Trust→ Openness	2	K11	.01	0.16	
Cognition Based Trust→ Conflict	3	K21	−.01	−0.16	
Trust Propensity → Openness	2	K12	.05	1.08	
Trust Propensity → Conflict	3	K22	−.01	−0.26	
Affect-Based Trust → Openness	2	K13	.51	8.34	**
Affect-Based Trust → Conflict	3	K23	−.47	−10.29	**
Openness → Success	4	B21	.09	1.81	*
Conflict → Success	4	B22	−.29	−4.41	**
Success → Cognition Based Trust	5	B13	.06	0.96	
Success → Affect Based Trust	5	B23	.16	3.35	**
Size → Openness		K14	.02	0.56	
Size → Conflict		K24	.01	0.44	
Size → Success		K34	−.06	−1.42	†
Cultural Congruence → Openness		K15	.05	0.77	
Cultural Congruence → Conflict		K25	−.36	−7.88	**
Cultural Congruence → Success		K35	.04	0.83	
Dependence → Openness		K16	−.04	−.96	
Dependence → Conflict		K26	.05	1.49	†
Dependence → Success		K36	−.08	−1.85	**
Contract Completeness → Openness		K17	.08	1.92	**
Contract Completeness → Conflict		K27	−.07	−2.21	**
Contract Completeness→ Success		K37	.04	0.83	
Model χ^2	10.78				
P	< 0.05				
GFI	.99				
AGFI	.94				
CFI	.99				
NNFI	.95				
RMSEA	.04				
CI	90% (0.00;0.05)				

† $p < .10$, * $p < .05$, ** $p < .01$

Hypothesis 2. Like predicted, all forms of trust are positively related to openness. While the path from affect-based trust to openness is significant ($\gamma_{13} = 0.51, t = 8.34, p < 0.01$), the paths from cognition based trust to openness ($\gamma_{11} = 0.01, t = 0.16, \text{n.s.}$) and of trust propensity to openness ($\gamma_{12} = 0.05, t = 1.08, \text{n.s.}$) are not significant. Hypothesis 2 is thus partially supported.

Hypothesis 3. As predicted, all three dimensions of trust reduce the levels of destructive conflicts. However, the path between cognition based trust and conflict is not significant ($\gamma_{21} = -0.01, t = -0.16, \text{n.s.}$). The same yields for the path between trust propensity and conflict ($\gamma_{22} = -0.01, t = -0.26, \text{n.s.}$). The path between affect based trust and conflict is negative and significant ($\gamma_{23} = -0.47, t = -10.29, p < 0.01$). Hypothesis 3 is thus partially supported.

Hypothesis 4. The influence of openness on relationship success is positive and significant ($\beta_{21} = 0.09, t = 1.81, p < 0.05$). The effect of conflict on success is negative and significant ($\beta_{22} = -0.29, t = -4.41, p < 0.01$). Both results align with the predictions. Hypothesis 4 is thus fully supported.

Hypothesis 5. Success is positively related to cognition based trust but not significant ($\beta_{13} = 0.06, t = 0.96, \text{n.s.}$). The influence of success on affect-based trust is positive and significant ($\beta_{23} = 0.16, t = 3.35, p < 0.01$). Hypothesis 5 is thus partially supported.

Overall, we have significant results for five of the ten paths that we tested in the model. The results provide support for the role of different dimensions of trust on the performance of business relationships in high tech industries. Affect based trust emerged as more influential than cognition based trust and trust propensity. Relationship success is fostered by openness whereas destructive conflicts diminish success. The results also show that feedback mechanisms work from success to affect

based trust but not from success to cognition based trust. We observed these results after accounting for the influence of the relationship's formal context (legal arrangements operationalized by contract completeness) and controlling for size, dependence and cultural congruence.

Control variables

The correlations for the control variables (Table 1) suggest that the larger firms in the sample develop more complete contracts ($R^2 = 0.13, p < 0.01$). Large firms, however, are not more independent than small firms ($R^2 = 0.01, n.s.$). Nevertheless a more complete contract does reduce interorganizational dependence ($R^2 = -0.15, p < 0.01$). Cultural congruence between business partners appears to be a relative exogenous parameter compared to others that co-determine the context of business relationships.

Size. Size is positively related to openness, but the relationship is not significant ($\gamma_{14} = 0.02, t = 0.56, n.s.$). The same yields for the effect of size on conflicts, it is positively but non significantly related to conflicts ($\gamma_{24} = 0.01, t = 0.44, n.s.$). Size is significantly and inversely related to success ($\gamma_{23} = -0.06, t = -1.42, p < 0.10$) although some care needs to be taken because of the low level of significance. Apparently, large organizations perceive business relations to be less successful.

Dependence. In the results shown in Table 2, dependence is not significantly related to openness ($\gamma_{16} = -0.04, t = -0.96, n.s.$). Dependence is positively and significantly related to conflict ($\gamma_{26} = 0.05, t = 1.49, p < 0.10$) and, in line with this, significantly and inversely related to success ($\gamma_{36} = 0.08, t = -1.85, p < 0.01$). The negative sign reflects the fact that higher dependence is linked to lower levels of perceived relational success. These results are consistent with the expectation that a more dependent firm will have a more vulnerable position in the relationship and consequently an increased fear for opportunism. The hypothesized results were increased defensive behavior and hence conflicts (e.g. Zand 1972). The positive relationship with conflicts and the negative relationship with success, confirm these expectations.

Contract completeness. A more complete contract results in more openness, the path between these two constructs is positive and significant ($\gamma_{17} = 0.08$, $t = 1.92$, $p < 0.01$). Contract completeness is significantly and inversely related to conflicts ($\gamma_{27} = -0.07$, $t = -2.21$, $p < 0.01$). Contract completeness, however, has no significant relationship with success ($\gamma_{37} = 0.04$, $t = 0.83$, n.s.). The latter does not support the suggestion from contract theory that efficient outcomes are only possible when contracts are fully specified or, in other words, that firms need to safeguard to the maximum to be able to achieve successful relationships (Chen 2000, Lyons and Mehta 1997, Williamson 1985). The results confirm the perception that contracts form a basis on which parties can be open because spill-over risks are safeguarded (Zucker 1986) while contradicting suggestions that extensive contracts lead to distrust and conflicts, thereby harming openness and success (Bradach and Eccles 1989, Goshall and Moran 1996).

Cultural congruence. Cultural congruence is positively related to openness, but the relationships is not significant ($\gamma_{15} = 0.05$, $t = 0.77$, n.s.). The same yields for the effect of cultural congruence on success, it is positively but not significantly related ($\gamma_{35} = 0.04$, $t = 0.83$, n.s.). Cultural congruence is significantly and inversely related to conflicts ($\gamma_{25} = -0.36$, $t = -7.88$, $p < 0.01$). These results show that there is a direct relationship between cultural congruence and the level of destructive conflicts –which is consistent with the expectation– but that there is no direct relationship with openness and success.

Comparing plausible alternative models

Tests of a hypothesized model can indicate either support or lack of support for it. The explicit rejection of competing models strengthens the validity of hypothesized causal relationships (Anderson and Gerbring 1988). Therefore, we developed a set of plausible alternative models and compared them sequentially to the research model using standard structural equation modeling procedures to examine the level of support in the data for each (cf. Subramani and Venkatraman 2003). Table 4 reports

results of these tests.

TABLE 4
Fit Statistics of Research Model and Alternative Theoretical Models

Statistic	Research Model	Alternative Model 1: No Trust	Alternative Model 2: Limited Trust
Model χ^2	10.78 ($p < 0.05$)	41.94 ($p < 0.00$)	45.38 ($p < 0.00$)
χ^2		31.16	34.60
GFI/AGFI	.99/.95	.97/.21	.98/.82
CFI/NNFI	.99/.95	.93/.55	.93/.60
RMSEA	.04	.32	.13
Result	Accepted	Rejected	Rejected

First, we tested a model that reflects the view that trust is completely irrelevant for business relationships. To that end we removed all trust variables from the research model. This alternative was rejected in favor of our research model. Second, we considered an alternative model that allows for a limited role of trust. In this alternative model we removed affect based trust but remained trust propensity and cognition based trust. This alternative model was also rejected in favor of our research model. The results of this sensitivity analysis supports the robustness of our research model.

6. DISCUSSION AND CONCLUSIONS

Overall, our results are consistent with the theoretical predictions. This study extends understandings of how vulnerable business partners, who typically do not have the opportunity to extract safeguards for the dedicated investments and sharing of knowledge ex ante, craft governance mechanisms that have the effect of safeguarding them ex post, through joint decision making. Our findings are consistent with the

logic of transaction cost theory, according to which relation specific assets in exchange need safeguards because farsighted parties would not invest in such assets otherwise (Williamson 1985). The following results are also worth highlighting. First, we found strong support for our three-dimensional conceptualization of trust comprising trust propensity, affect based trust and cognition based trust. This confirms the categorization of trust suggested by Mayer et al. (1995) and McAllister (1995). The three folded classification enables us to distinguish rational, calculative motivations from intrinsic motivations to trust. The classification is a refinement of the broader concept of 'trust'. By doing so, it allows fine-grained empirical tests of specific forms of trust on specific characteristics of relationship performance. Lack of empirical support in studies that use a broad concept may be the result of the fact that in a broad concept a host of different motivations and underlying reasons for firms to trust are combined. Different motives may have different effects (positive, negative or zero) and collectively outweigh each other. Our investigation shows a need to study each form of trust independently.

Second, we found that the different dimensions of trust each have distinct effects on relationship performance. It is interesting to find that both the propensity to trust and cognition based trust do not positively relate to openness or conflicts. Especially for cognition based trust this is remarkable because it seems to downsize game theoretic arguments that frame prior relationships as a crucial condition for the establishment of trust and success (Axelrod 1984). In high tech business relationships the rational extrapolation of positive past experiences may only be important during the first stage of the relationship when partners are selected and initial agreements are developed. Our results suggest that partners with a shared history are not more successful than those without past experience, nor do they have less conflicts or were their relationships characterized by more openness. In general, the results highlight the need for careful attention to the dimensionalization of trust in future studies.

Third, the results suggest that particularly affect-based trust decreases levels of conflicts while at the same time it increases openness and success. Affect based trust derives from intrinsic motivations. It is not rational in the sense that it is not based on earlier experiences with the same partner in which trust already is proven. To the best

of our knowledge, our results represent a first empirical demonstration of a value of trust in business relationships being more influential on performance than trust propensity or trust that is based on calculative grounds. This conclusion is also supported by the fact that we observed the effects while controlling for dependence and contracts. Dependence may explain success due to private ordering; contracts may explain success due to legal ordering. It is our suggestion that intrinsic motivations to trust enable 'the leap' beyond the expectations that reason and experience alone would warrant' (Bradach and Eccles 1989, Lewis and Weigert 1985). Hence, forms of trust other than those that depart from rational expectations based on reason or calculation (shadow of the future, contracts) or on experience (shadow of the past) exist and add value to business relationships.

Fourth, we conclude that in our sample of high tech business relationships there is no significant link between the level of detail of contracts and success. Furthermore, we find that the level of detail of contracts is positively related to openness and negatively to conflicts. These results go beyond recent suggestions that extensive contracts harm relationships because they evoke conflicts and decrease relationship quality (Goshall and Moran 1996, Lyons and Mehta 1997). Also, we find that success positively feeds back to affect based trust. In other words, successful relationships reinforce the positive feelings of trust, care and concern that business parties have. Contrary to expectations, this positive feedback does not exist from success to cognition-based trust.

Our study has several limitations. We collected data from business relationships in high tech industries to enhance internal validity and control for important context specific characteristics. This choice limits the generalizability of our results. Also, we interviewed one respondent per interorganizational collaboration. Although our respondents were the best-informed parties because they were the business manager for the business relationship, it does mean that we miss other perceptions on the relationship.

Our findings confirm earlier results. Nevertheless, it are the contradictory findings that draw our attention. Questions that deserve future attention are: How is it possible

that past experience does not increase openness and success? Why does affect based trust have such strong positive effects on relationship performance? What explains the limited role of cognition-based trust, trust propensity and detailed contracts on success of vulnerable relationships that we study?

Existing literature on trust and the governance of transactions, preliminary departs from the idea that vulnerabilities in a relationship should be safeguarded. Legal and private ordering are the main governance mechanisms to achieve this goal. Trust, conceptualized as an expectation based on e.g. earlier experiences, contracts, or mutual interests, can provide complementary or substitute governance mechanisms. However, there is increasing empirical evidence that firms often rely on rather 'loose' contracts and oral promises in stead of well designed governance structures (Bush and Horstman 1992, Hart and Moore 1990). To the best of our knowledge, there is no empirical evidence that these 'loosely' governed relationships are less successful than 'better' safeguarded ones.

To a large extent this still leaves the question of 'the leap of faith' in business relationships unaddressed. Following the results of our study we suggest that intrinsic motivations may provide an important explanatory factor for relationship performance. Through openness, business partners are able to discuss a wide range of issues – and by definition issues will arise in durable relationships. They also can share ideas and feelings that foster foundations for creativity and inspiration through which interfirm relationships achieve superior outcomes. These positive side-effects of relationships governed by trust are not likely to be provoked by rational extrapolations of positive past experiences nor by limiting opportunities for opportunism due to detailed contracts (Dyer and Chu 2003). This also may explain why neither contracts nor cognition based trust contribute to relationship success.

The fact that no positive relationship was found between contract completeness and relationship success, while contracts do contribute to openness and decreases conflicts, suggests that contracts should not be considered as an uni-dimensional legal document to safeguard relationships. In stead, contracts should be envisioned as multi-dimensional agreements that can also signal trust and commitment between business partners. This alternative interpretation of the role of contracts in business

relationships explains that contracts may positively influence performance.

To further explore these questions, future research should delve deeper into the characteristics of trust that have no rational or calculative basis and examine the role of this form of trust in interorganizational relationships. Recent developments in experimental game theory provide convincing evidence that actors are more inclined to behave trustworthy (i.e., grant benefits to the other, maximize joint benefits at the cost of self-interest, refrain from opportunism at the cost of losing own income) than economists traditionally assume (Chen, 2000, Fehr et al. 2001, Fehr and Falk 2002). This inclination to trustworthy behavior even holds in situations where players are anonymous, i.e., where actors cannot be punished by reputation or by a 'shadow of the future' (Belschak 2003, Camerer 2003). The implication is that people have an intrinsic motivation to become friends, also with business partners. Factors such as loyalty and inspiration form important motivations next to and on top of self-interest and profit maximization. Although such factors may be less important for transactions of (homogenous) commodity goods, they almost logically play an important role in high-tech, innovative relationships in which people together create new ideas and where creativity is not likely to be stimulated by lengthy contracts or rational calculations.

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